

PATENT ABSTRACTS OF JAPAN

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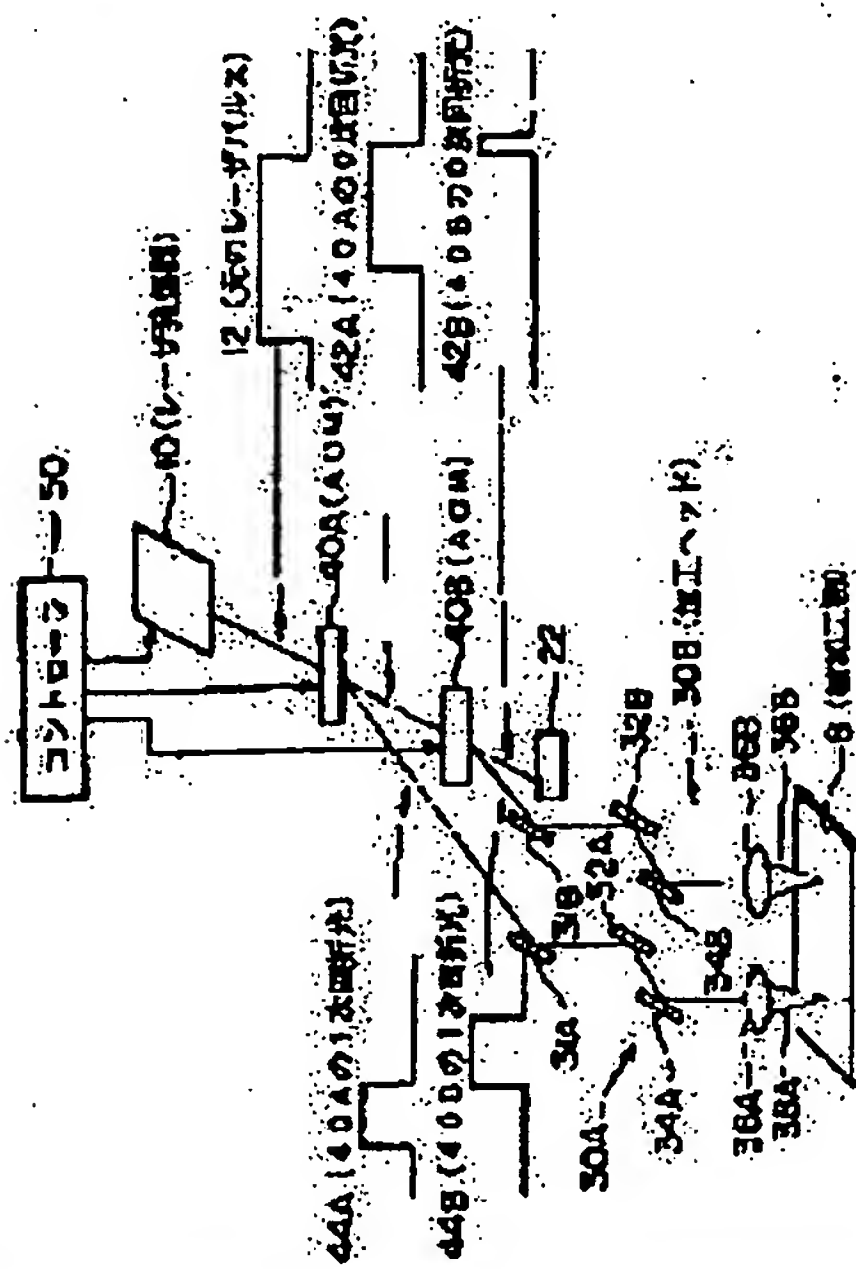
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(22)Date of filing : 16.08.2001 (72)Inventor : YOKOTA SHIRO

(54) METHOD AND DEVICE FOR LASER BEAM MACHINING



(57)Abstract:

PROBLEM TO BE SOLVED: To increase a machining speed when the machining is performed by supplying a pulse laser beam outputted from one laser oscillator to a plurality of machining heads.

SOLUTION: The pulse laser beam 12 is time-divided in the pulse and supplied to respective heads 30A and 30B.

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rejection]

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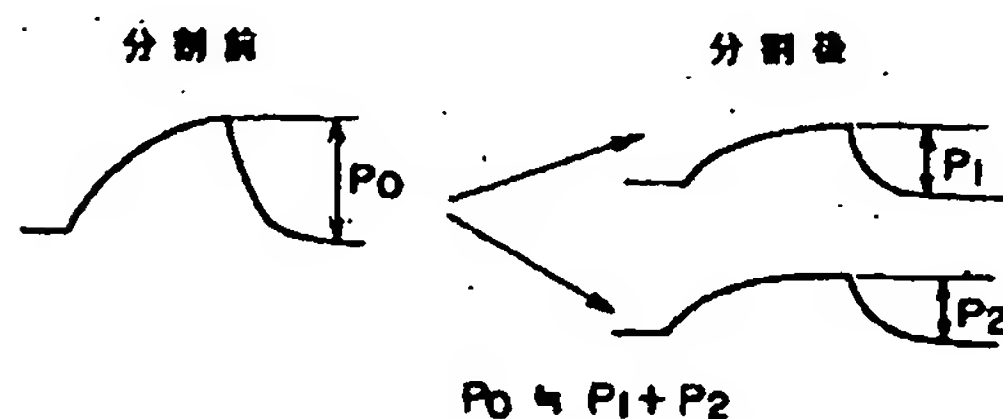
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[Claim(s)]

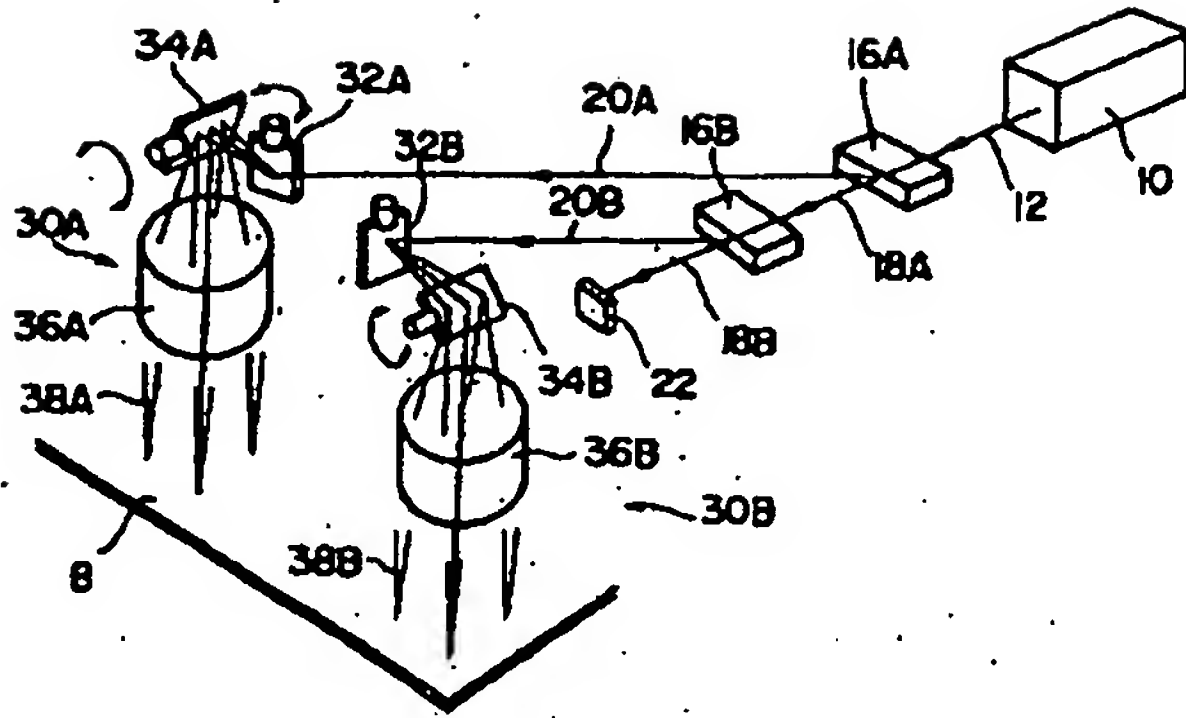
[Claim 1] The laser-beam-machining approach characterized by carrying out time sharing of said laser beam within a pulse, and supplying each processing head in the laser-beam-machining approach which supplied the laser beam of the shape of a pulse outputted from one set of a laser oscillation machine to two or more processing heads.

[Claim 2] Laser-beam-machining equipment characterized by having a time-sharing means for carrying out time sharing of said laser beam within a pulse, and a means for supplying the laser beam by which time sharing was carried out with this time-sharing means to each processing head in the laser-beam-machining equipment which supplied the laser beam of the shape of a pulse outputted from one set of a laser oscillation machine to two or more processing heads.

[Drawing 1]



[Drawing 2]



[Drawing 3]

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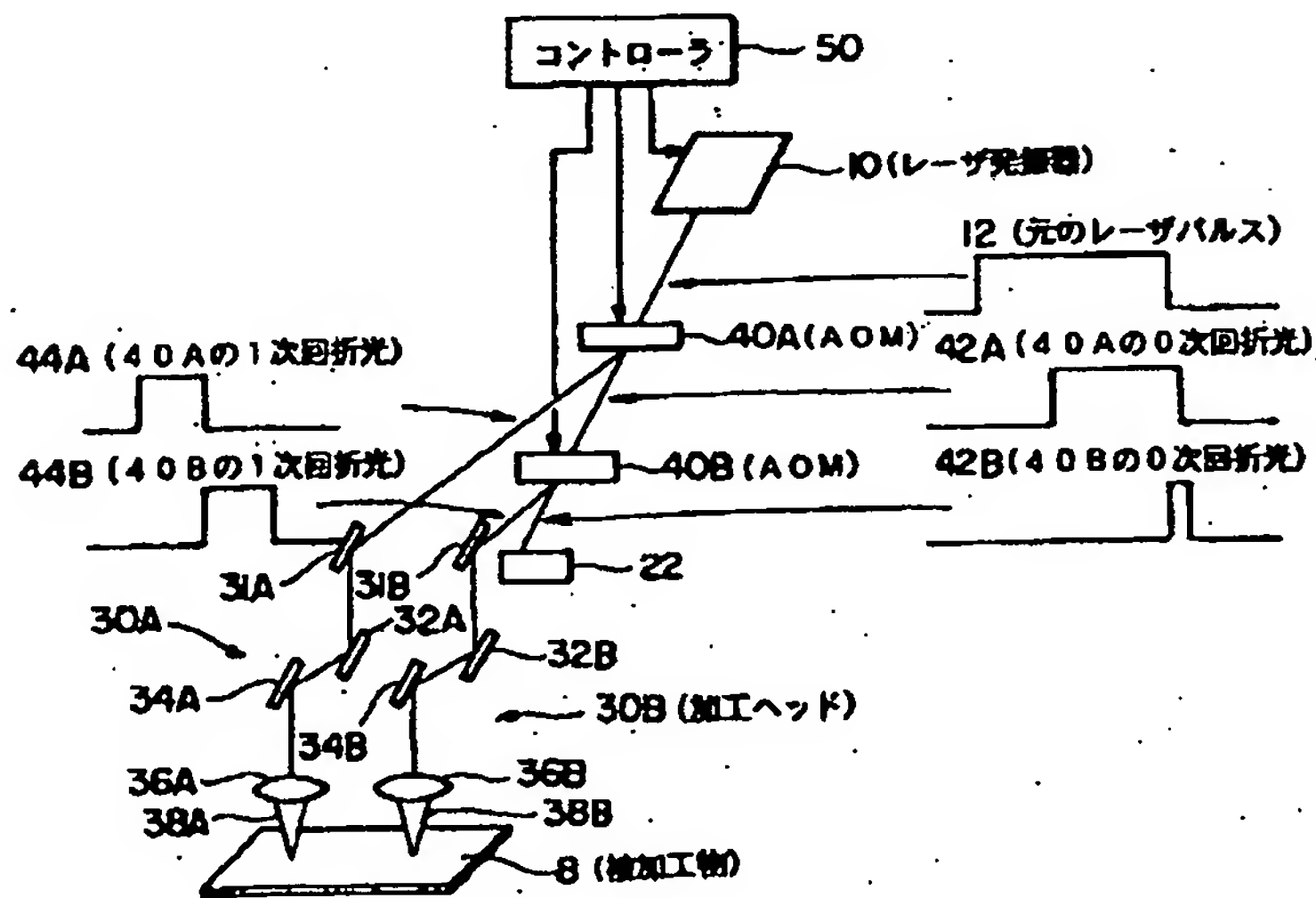
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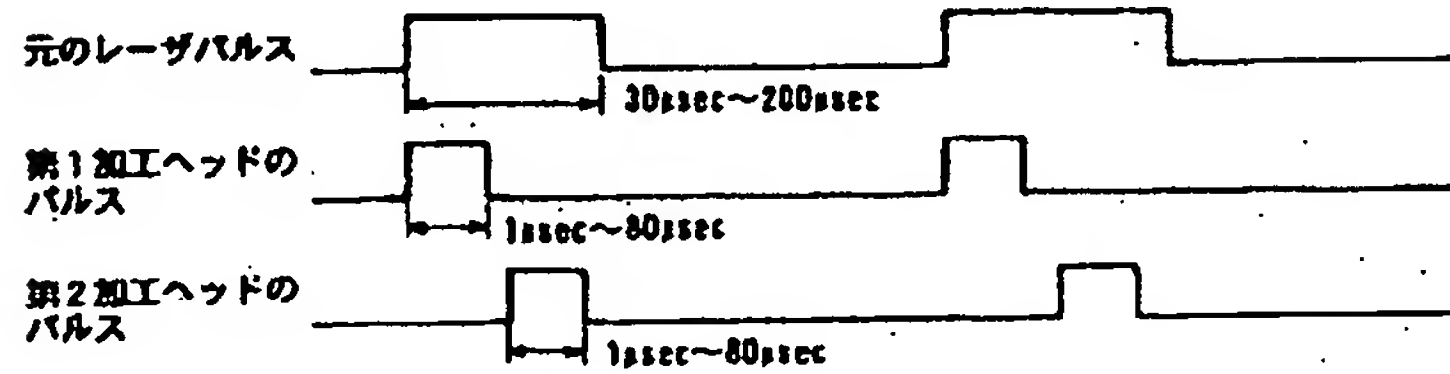
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[Drawing 4]



[Drawing 5]



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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the laser-beam-machining approach and equipment, and relates to amelioration of the laser-beam-machining approach and equipment which supplied the laser beam outputted from one set of a suitable laser oscillation machine to use for the laser hole dawn machine into which a printed circuit board is processed especially to two or more processing heads.

[0002]

[Description of the Prior Art] In order to form the through hole and beer hall with a diameter of 0.1mm or less which were miniaturized with a miniaturization and advanced features of the latest printed-circuit board with a sufficient precision, the laser beam of a pulse oscillation mold is used and the laser hole dawn machine which forms the hole of a minor diameter is put in practical use.

[0003] In this laser hole dawn machine, generally, in order to raise working capacity, breaking a hole is performed to the printed-circuit board with two or more processing heads at coincidence, in that case, a laser oscillation machine is communalized and a miniaturization and cost cut of equipment are achieved.

[0004] Carrying out energy division with splitter optics, such as a half mirror, a polarization mirror, and a beam splitter, and supplying conventionally, the laser beam outputted from one laser oscillation machine to two or more processing heads is performed in that case.

[0005] However, by this approach, in order to divide energy, as shown in drawing 1, in after the peaking capacity P0 of the laser beam before division dividing, it decreased (in 2 division, halved in P1 and P2), and had the trouble that the energy ratio when productivity not only falling, but dividing was also correctly uncontrollable.

[0006] In order to solve such a trouble to JP,2000-263271,A As shown in drawing 2, the laser beam 12 outputted from one set of the laser oscillation machine 10 Processing head 30A, Carrying out time sharing with the number of 30B (drawing two sets) and the same number ***** beam distribution plastic surgery equipments 16A and 16B, supplying the laser beams 20A and 20B of the shape of this pulse which carried out time sharing to the processing heads 30A and 30B, respectively, and using them for processing of a workpiece 8 is proposed.

[0007] In drawing, the zero-order light in which 18A and 18B passed the beam distribution plastic surgery equipments 16A and 16B, respectively, and 22 The beam dump for absorbing zero-order light 18B, and 32A and 32B The 1st galvanomirror for scanning in the 1st respectively level direction, and 34A and 34B the primary light 18A and 18B by which time sharing was carried out with said beam distribution plastic surgery equipments 16A and 16B The 2nd galvanomirror for scanning the beam scanned in the 1st level direction with this 1st galvanomirror 32A and 32B in said 1st direction and the 2nd level direction which intersects perpendicularly, 36A and 36B are ftheta lenses for condensing the laser beam horizontally scanned with said 1st and 2nd galvanomirrors 32A, 32B, 34A, and 34B, and hitting against a workpiece 8 as processing beams 38A and 38B.

[0008]

[Problem(s) to be Solved by the Invention] However, by the approach proposed by

JP,2000-263271,A, it had the trouble that coincidence processing with both the processing head could not be performed, and quick processing could not do it since the laser beam 12 outputted from the laser oscillation machine 10 was distributed in each processing head 30A and the direction of 30B for every pulse as shown in drawing 3.

[0009] This invention is [0010] which makes it a technical problem to have been made in order to solve said conventional trouble, to enable coincidence processing by two or more processing head, and to enable quick processing.

[Means for Solving the Problem] In the laser-beam-machining approach which supplied the laser beam of the shape of a pulse outputted from one set of a laser oscillation machine to two or more processing heads, as this invention carries out time sharing of said laser beam within a pulse and supplies it to each processing head, it solves said technical problem.

[0011] Similarly this invention solves said technical problem in the laser-beam-machining equipment which supplied the laser beam of the shape of a pulse outputted from one set of a laser oscillation machine to two or more processing heads again by having a time-sharing means for carrying out time sharing of said laser beam within a pulse, and a means for supplying the laser beam by which time sharing was carried out with this time-sharing means to each processing head.

[0012]

[Embodiment of the Invention] With reference to a drawing, the operation gestalt of this invention is explained to a detail below.

[0013] This operation gestalt carries out time sharing of the laser beam 12 outputted from the laser oscillation machine 10 within a pulse, as shown in drawing 4. 1st sound modulation element (AOM) 40A for supplying primary diffracted-light 44A to 1st processing head 30A, Time sharing of the zero-order diffracted-light 42A which passed 1st AOM40A as shown in drawing 4 is carried out within the same pulse as primary diffracted-light 44A. this -- It has 2nd AOM40B for supplying primary diffracted-light 44B to 2nd processing head 30B, and the controller 50 for considering said 1st and 2nd AOM(s) 40A and 40B as sequential ON within 1 pulse of said laser beam 12.

[0014] Said AOM(s) 40A and 40B start the pulse of a laser beam by turning force current on and off on a predetermined frequency using the principle which changes the angle of refraction of a diffraction grating.

[0015] Said processing heads 30A and 30B use only said primary diffracted lights 44A and 44B of AOM(s) 40A and 40B for processing. At this time, pulse energy can be adjusted to arbitration by controlling the pulse width started from the original laser beam 12.

[0016] The location of the processing beams 38A and 38B is controlled by Galvanomirrors 32A, 32B, 34A, and 34B, it is condensed by the processing point with the ftheta lenses 36A and 36B, and said diffracted light of AOM(s) 40A and 40B performs perforation of a workpiece 8 etc., after being given to the processing heads 30A and 30B which became independent, respectively and adjusting the direction of incidence by the reflective mirrors 31A and 31B.

[0017] The pulse height which the original laser pulse has at this time can be maintained without decreasing almost, when it branches by AOM(s) 40A and 40B. Moreover, by making adjustable pulse width to start, independently, since it is controllable, the amount of energy can also make almost the same continuously energy which arrives at a

processing side with two processing heads 30A and 30B.

[0018] A laser oscillation machine with the pulse width for a maximum of 200 microseconds is used, and the example which branched to energy is shown in drawing 5. Thus, quick processing is attained by dividing towards two processing heads within 1 pulse. In addition, it is also possible for the number of partitions not to be limited to 2, but to divide or more into three.

[0019] In addition, in said operation gestalt, although AOM was used as a time-sharing means, a time-sharing means is not limited to AOM. The candidate for application is not limited to a punching machine, either.

[0020]

[Effect of the Invention] According to this invention, a laser beam is supplied to two or more processing heads within 1 laser pulse, and it becomes possible to perform quick processing. Furthermore, by the polarization mirror etc., compared with the case where energy division is carried out, since the peak height of a pulse is high, it excels in the workability of copper foil or resin.